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Title: NOAA Future Environmental Remote Sensing Capabilities Request for Information

Contracting Officer: Sarah McKim

THIS IS A REQUEST FOR INFORMATION (RFI). As part of its advanced planning for future environmental systems, NOAA is soliciting information on space architecture studies, instruments (including instrument technology), payload hosting opportunities and partnerships, planned commercial data services, and communication services. This is an RFI only and is not a solicitation for a contract or grant award. This RFI notice is for informational purposes only. It is not a request for proposals, and it does not obligate the government in any way. The Government will not reimburse the respondents for any costs associated with the information submitted in response to this request.

Background

The National Oceanic and Atmospheric Administration (NOAA) is conducting a study of future satellite environmental remote sensing capabilities, defined here to include weather, space weather, and other environmental remote sensing (excluding land mapping). NOAA is requesting information from industry and other organizations in support of this study. NOAA's objective is that this study will lead to a definition of next generation satellite programs starting operations circa 2030 (meaning initial operational capability starting 2028 and full operational capability starting 2031). The study's primary intent is to resolve foundational questions in the circa 2030 space segment architecture, such as:

- The most appropriate distribution of functions to orbits, including whether the legacy distribution among low and geostationary Earth orbits is most appropriate or whether some alternative distribution would be more cost effective.
- The appropriate role (if any) of platforms in additional orbits (e.g., non-sun-synchronous, high inclination, and libration point) in the above environmental remote sensing capabilities.
- The return on investment, in more valuable data or lowered cost, through use of new instrument technologies.
- Opportunities and risks in increasing or decreasing environmental data collection capabilities as a function of overall available budget levels.

As part of this study, NOAA is developing a mission value model for future environmental remote sensing capabilities, mapping mission value to existing and potential data products, populating a catalog of instrument capabilities estimated circa 2030, and analyzing reference constellations in different combinations of orbits with differing sustainment strategies. The submissions to this RFI may be used in any of these areas. Through this RFI, NOAA seeks to have its study include the most innovative concepts developed within the community and to avoid the limitations of pre-conceived notions of legacy requirements or missions. As part of this study, NOAA will consider various relationships between the

government and industry in developing, launching, and operating environmental remote sensing satellites. These relationships are expected to include the standard approach of procuring government-owned satellite systems. But, they also may include payload hosting, payload partnerships, and service buys.

Environmental satellites are a major component of NOAA's global efforts to better observe, understand, and predict environmental phenomena. NOAA currently collects environmental remote sensing data from space via two major satellite programs and via other smaller programs (e.g., Jason 2 Ocean Surface Topography Mission, Deep Space Climate Observatory (DSCOVR)). NOAA's major current operational programs are the Geostationary Operational Environmental Satellite (GOES) program, now transitioning from the NOP series to the RSTU series, and the Joint Polar Satellite Systems (JPSS) program. GOES and JPSS provide critical atmospheric, oceanic, terrestrial, climatic, solar, and space data. Satellites in the GOES-R and JPSS programs carry instruments to support NOAA's science missions and communications payloads to support various operational missions for NOAA and other Agencies. Circa 2030, NOAA projects that a new generation of satellites will be needed to replace the GOES-R, JPSS, and other satellites currently in development and operation. The overall architecture of the next generation constellation is the subject of the current NOAA study.

Purpose

The purpose of this RFI is to solicit information from industry to support development of the NOAA NESDIS Weather Satellite Enterprise Architecture. The scope of this architecture will include space segment assets for weather, space weather, and environmental remote sensing (excluding land mapping) and associated service provision from space circa 2030. To develop this architecture, NOAA needs information on architecture studies outside NOAA, instruments (including instrument technology), payload hosting opportunities and partnerships, planned commercial data services, and communication services.

This is a request for information only, and does not obligate the government to reimburse any costs associated with the preparation and/or submission of this information. Nor does this RFI guarantee that the government will issue a request for proposal or award a contract for supplies or services. No specific RFP is planned to follow this RFI; however, the responses could impact the government's decision to release an RFP in the future.

The Government shall not be liable for or suffer any consequential damages for proprietary information not properly identified. Proprietary information will be safeguarded in accordance with the applicable Government regulations.

Information Requested

Interested firms should submit a response with a written statement of interest or capability and discussion on one or more of the following points:

1. **Environmental Remote Sensing Architecture Studies**
   Studies that may have been conducted looking at requirements and space segment alternatives circa 2030. Primary interest would be in studies that have considered broad change to the allocation of functions to platforms or orbits and broad consideration of the environmental remote sensing functions from space.

2. **Instruments**

It is highly desirable for the future collection architecture to maintain existing measurements as well as to add new measurements of high value to environmental remote sensing (including forecasting capabilities). For each instrument type, responders should describe how technologies can be utilized to provide a) lower cost and reduced technical resource requirements while maintaining continuity of performance with the current generation of systems, or b) enhanced performance at a level that impacts missions of interest. Both projected cost and technical performance are of interest. Example types of instruments of interest include:

- Moderate resolution imagers equivalent to current imagers such as VIIRS, MODIS, and ABI. These are characterized by spatial resolution in the range of 2 km to 500 meters, wavelength coverage from visual bands to 13 microns, moderate spectral resolution, sufficient signal-to-noise ratio to allow processing of specialized products (e.g.; aerosols, cloud structure, ocean color), and precise standards-traceable radiometric calibration.
- Microwave and infrared sounders with spectral resolution sufficient to recover vertical temperature and humidity profiles, surface temperatures, and chemical species (state which species are recovered).
- Hyperspectral imagers with an ability to produce both imaging and sounding data products through appropriate processing.
- Solar telescopes of all types (x-ray, ultraviolet, coronagraph, magnetographic).
- Ozone vertical profilers.
- Instruments, active or passive, capable of measuring wind velocity and direction, either surface only or in three-dimensions. Include discussion of what:
    i. Level of spatial and temporal accuracy is achieved
    ii. Atmospheric conditions enable the measurement to be effective, and what atmospheric conditions may limit the effectiveness of the measurement, for the wavelength range selected
- Instruments capable of characterizing ice conditions and movement.

For instruments which use distributed sensing (e.g., remote sensing from multiple spacecraft), discuss:

- Required orbital and vehicle pointing relationships, i.e., what relative position do the instruments need to maintain and how accurately do they need to be pointed with respect to both the observable and the adjacent spacecraft in the constellation?
- How coordinated do the operations of the spacecraft in the constellation need to be in order for the measurement approach to work?
- What approach is used to maintain constellation formation control, and has the approach been demonstrated?

3. **Payload Hosting and Partnerships**

Current NOAA missions utilize dedicated satellite buses. There is active interest in payload hosting arrangements where a NOAA payload may share bus space and resources with another, often commercial, mission. In addition to standard hosting arrangements, where a satellite

operator hosts a single Government payload among its own payloads, the Government has interest in multiple satellite and payload hosting partnerships, such as in hosting multiple payloads on a commercial constellation. Issues of interest include:

- Ability to host large optical payloads, such as the Advanced Baseline Imager on GOES-R, with challenging pointing and stability requirements and large data downlink requirements. Ability to host payloads with other specialized requirements, such as solar pointing telescopes. Describe hosting accommodations (e.g., size, weight, power, built-in communications) projected to be available for payload use, potential orbital locations, and projected costs.

- Hosting opportunities available in non-geostationary orbits, especially sun-synchronous orbits, and in LEO constellations. Describe available size, weight, power, built-in communications available for payload use, and projected costs.

- Hosting partnerships, e.g., where a geospatial imaging constellation could accommodate environmental imaging requirements through additional or modified (developed) capabilities. Describe available size, weight, power, built-in communications available for payload use, and projected costs.

4. Data Services

NOAA will consider using arrangements where the hardware contractor builds and operates a satellite constellation and the Government contracts for data delivery with specified quality and reliability rather than system delivery. Suppliers are invited to describe potential data as a service offering. Particular areas of interest include:

- Commercial interest in supplying one or more major categories of environmental data (e.g., real-time multi-spectral imagery, non-real-time global multi-spectral imagery, infrared and/or microwave atmospheric vertical soundings, GNSS radio occultation soundings) as a service.
- Compatibility of potential service offerings with established open data access and international data exchange policies.
- Provisions for providing service assurance with data supply contracts, both against technical failures (e.g.; launch failures, spacecraft or payload failures) and business risks.
- Approaches to offering data services with complex requirements, such as precise calibration and continuity of measurements between system generations.
- Projected costs and associated business models, including the degree of Government commitment required and the existence of non-Government markets for the services. Business risks to the approach and means for mitigating those risks for mission critical data sets.
- Approaches to structuring data and metadata from a potential service to facilitate fusion with other sources by the end-user.

5. Communication Services

NOAA currently supplies multiple communications services from GOES and polar satellites. Provisioning these services requires a significant amount of satellite payload mass and power.

Compared to when these services were first developed, there is now a much richer set of commercial satellite communication services. NOAA requests information on projected satellite communication services circa 2030 in the following categories. For each category, NOAA is interested in the projected user ground terminal burden (size, weight, power, antenna requirements for the ground terminal), individual user capacity, aggregate capacity in users, end-to-end latency, business model, and costs for accommodating NOAA communication needs.

- Distribution of high speed data with strict, fixed latency requirements at rates up to 100 Mbits/sec. Distribution would be from a small number (1-5) of injection points to a larger number (~100) of distribution points throughout the western hemisphere, possibly including a few ships or other mobile platforms.
- Distribution of medium to low speed data (<1 Mbit/sec) from a small number (1-5) of injection points to a large number (hundreds) of distribution points, including austere terminals. An austere terminal would be one suitable for use in emergency situations (e.g., post-hurricane disaster response).
- Collection of small amounts of data (10 messages per day of a few hundred bytes) from >1000 remote sensor locations.
- Geolocation and collection of short message data from thousands of mobile ground terminals. Minimizing user terminal footprint in size, weight, power, and antenna requirements is a major objective in this service category.

Point of Contact

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Instructions for Submission

Respondents are hereby notified that NOAA may share responses with other government agencies, especially the National Aeronautics and Space Administration (NASA), and that the government may utilize Federally Funded Research and Development Centers (FFRDCs) and support contractors to provide technical advice and evaluate responses. All personnel assigned to assist in the RFI assessment will sign both nondisclosure and conflict of interest forms and will be made aware that responses shall not be duplicated, used, or disclosed in whole or in part for any purpose other than to consider the response. Any material received will be treated as public domain unless clearly marked (on each page) as proprietary.

RFI responses must be received by the Contracting Officer at the e-mail address provided above in softcopy no later than 5:00PM Eastern Time on October 9, 2015. The government is not obligated to review responses to this RFI received after the deadline. Submissions are limited to not more than 15 pages, including supporting appendices, title page(s), all graphics, pictures and figures. A page is defined as each face of an 8 1/2 by 11 inch sheet with information contained within an image area of 7 by 9 inches. Type size shall be 12 point proportional font. Information shall be submitted in Microsoft Word or Adobe Acrobat (PDF) format.

Issues and questions regarding this RFI shall be submitted to the Contracting Officer at the e-mail address provided above by September 11, 2015 at 5:00PM Eastern Time. Respondents should be

advised that questions submitted may be posted to FedBizOpps for all respondents to review, although the identity of the requesting organization will be withheld. Responses to questions will also be posted to FedBizOpps. Respondents may reply to some of all of the RFI.

If contractors decide not to respond to this RFI, it will not preclude them from submitting a proposal for any subsequent NOAA or NASA work.

The government would like to thank all respondents in advance for expending the time and resources in support of this critical activity.